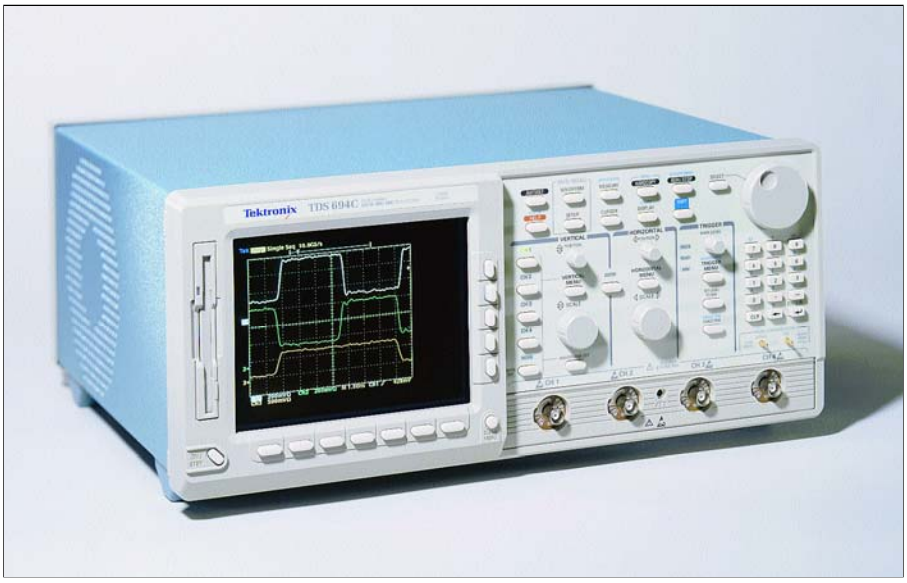
Tektronix

TDS 694C, TDS 684C, TDS 680C, TDS 654C Digital Real-Time™ Oscilloscopes



FEATURES AND BENEFITS

3 GHz, 1 GHz and 500 MHz Bandwidth to Work with the Fastest Signals in Today's Digital Designs

10 GS/s and 5 GS/s Sample Rate on all Channels Simultaneously for Full Bandwidth Single-shot Capture

Histograms and Measurement Statistics to More Fully Characterize Design Performance

Support for Java™ Applications Packages

Hard Disk Drive Storage (option)

APPLICATIONS

Validation and Characterization of High Speed Digital Designs

Telecommunications/Data Communications Design

High Energy Physics

Whether you are working on next generation microprocessor designs, high-speed data communications equipment, or in high-energy physics research, the TDS 694C captures your fastest signals with the best fidelity and resolution available. Its 3 GHz bandwidth preserves your waveform's fast rising edges and accurately shows signal details. With 10 GS/s digitizing rate simultaneously on all four channels and a high-stability timebase, the TDS 694C makes your critical timing measurements with the highest resolution and accuracy – even channel-to-channel measurements made in a single acquisition.

The TDS 600C oscilloscopes incorporate all the advanced trigger features you expect in a high performance oscilloscope. The TDS 694C can be configured for cross triggering with a Tektronix TLA 700 Logic Analyzer.

The TDS 600C oscilloscopes give you the total solution to your digital design characterization and debugging needs. Now you have the tool you need to verify design margins, characterize setup and hold times, and measure clock-to-data skew on the fastest digital designs.

The TDS 600C offers 29 automatic measurements, with measurement statistics, to make your design verification and characterization job much faster and easier. Available Java-based application packages for Jitter Analysis, Disk Drive measurements and Processor Specification measurements provide customized measurements and analysis capability. The TDS 600C gives you the performance and features you need to get your job done faster and more thoroughly.

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TDS 600 Series Characteristics

	TDS 654C	TDS 680C	TDS 684C	TDS 694C
Total Channels	4	2 + 2	4	4
Sample Rate (all channels simultaneously)	5 GS/s	5 GS/s	5 GS/s	10GS/s
Real-time Bandwidth	500MHz	1 GHz	1 GHz	3GHz
Maximum Record Length per Channel	15,000 pts	15,000 pts	15,000 pts	120,000pts
Vertical Resolution	1mV/div – 10V/div	1mV/div – 10 V/div	1mV/div – 10V/div	10mV/div – 1V/div
Time Measurement Accuracy	<50ps @ 5GS/s	<50ps @ 5 GS/s	<50ps @ 5GS/s	15 ps @ 10GS/s
Histograms and Measurement Statistics	Std.	Std.	Std.	Std.
Standard Probes	4 P6243	None	None	None
Display Type	7 in. color	7 in. mono	7 in. color	7 in. color
GPIB Port, RS-232 & Centronics	Std.	Std.	Std.	Std.
VGA	Std. Color	Std. Mono	Std. Color	Std. Color
Hard Disk Drive	Opt.	Opt.	Opt.	Opt.

TIME BASE SYSTEM

Time Bases – Main and Delayed.

Time/div Range – 200ps/div to 10 s/div. Except TDS694C: 100ps/div to 10 s/div.

Time Base Accuracy – Over Any Interval >1 ms ±100ppm. Except TDS 694C: Over any interval > 1 ms ± 10ppm.

Time Interval Measurement Accuracy – TDS 654C/680C/684C: ±[(0.2/sample rate) + (100ppm x |Reading|)] single shot. (≈ 50ps @ 5GS/s)
TDS 694C: ±[(0.15/sample rate) + (10ppm x |Reading|)] single shot. (≈ 15ps @ 10GS/s)

Record Length per Channel – 500 to 15,000 pts. Except TDS 694C: 500 to 30,000 pts. (optional: 120,000 pts.)

Trigger Jitter – 8ps RMS (typical).

Pre-Trigger Position – 0% to 100% of Record.

Channel to Channel Deskew Range – ±25 ns.

VERTICAL SYSTEM

Vertical Resolution – 8-Bits (>11-Bits with averaging).

Vertical Sensitivity – 1mV/div to 10V/div. Except TDS 694C: 10mV/div to 1V/div.

Maximum Input Voltage – 300V CAT II; ±400V peak. Derate at 20dB/decade above 1MHz. Except TDS 694C: 5V RMS.

DC Gain Accuracy – ±1.50%. Except TDS 694C: ±1.0%.

Position Range – ±5 divs.

Offset –
±1V from 1 to 99.5mV/div, ±10V from 100mV to 995mV/div, ±100V from 1V to 10V/div.
Except TDS 694C: ±0.5 V from 10 to 50mV/div, ±0.25V from 50.5 to 100mV/div, ±5V from 101mV to 500mV/div, ±2.5V from 505mV to 1V/div.

Bandwidth Selections – 20MHz, 250MHz, and Full. Except TDS 694C: Full only.

Input Impedance Selections – 1 MΩ in parallel with 10pF, or 50 Ω (AC and DC coupling). Except TDS 694C: 50 Ω (DC coupled).

Input Coupling – AC, DC or GND. Except TDS 694C: DC or GND.

AC Coupled Low Frequency Limit (Except TDS 694C) – <10Hz when AC, 1MΩ coupled. <200kHz when AC, 50 Ω coupled.

ACQUISITION MODES

Peak Detect – High frequency and random glitch capture. Captures glitches of 1ns using acquisition hardware at all real-time sampling rates. TDS 694C captures glitches of 100 ps.

Sample – Sample data only.

Envelope – Max/min values acquired over one or more acquisitions.

Average – Waveform data from 2 to 10,000 waveforms (selectable) is averaged.

Single Sequence – Use RUN/STOP button to capture a single triggered acquisition at a time, which may be automatically saved to NVRAM with AutoSave.

TRIGGERING SYSTEM

TRIGGER TYPES

EDGE (Main and Delayed) –
Conventional level-driven trigger. Positive or negative slope on any channel or rear panel auxiliary input. Coupling selections: DC, AC, noise reject, HF reject, LF reject.

LOGIC (Main) –
PATTERN: Specifies a logical combination (AND, OR, NAND, NOR) of the four input channels (high, low, don't care). Trigger when pattern stays true or false for a specified time.
STATE: Any logical pattern of channels 1, 2, and 3 (AUX1 on TDS680C) plus a clock edge on channel 4 (AUX2 on TDS680C). Triggerable on rising or falling clock edge.
SETUP/HOLD: Trigger on violations of both setup time and hold time between clock and data which are on two input channels.

PULSE (Main) –
GLITCH: Trigger on or reject glitches of positive, negative, or either polarity. Minimum glitch width is 1.0ns with 200ps resolution.
RUNT: Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again.
WIDTH: Trigger on width of positive or negative pulse either within or out of selectable time limits (1ns to 1 s).
SLEW RATE: Trigger on pulse edge rates that are either faster or slower than a set rate. Edges can be rising, falling, or either.

TDS 600 Series Characteristics Continued

TIMEOUT: Trigger on an event which remains high, low, or either, for a specified time period, selectable from 1ns to 1 s, with 200ps resolution.

TLA Cross Trigger (TDS 694C only) – Utilize a TLA700 logic analyzer to detect a multi-channel event, then trigger the TDS 694C. The trigger points on the TLA and TDS will be aligned in time.

VIDEO (Optional; Not Available in TDS 694C) –
Trigger on a particular line of individual, odd/even, or all fields. Trigger on a specific pixel of a line by using the video trigger with delay by events. Choose positive or negative horizontal sync polarity.
525/NTSC: Choose monochrome or color (studio-quality NTSC) sync formats.
625/PAL: Choose color or monochrome (studio-quality PAL) sync formats. HDTV: Choose from 1125/60, 1050/60, 1250/50, and 787.5/60 HDTV formats.

Trigger Bandwidth (Edge Type) –
3 GHz (TDS 694C).
1 GHz (TDS 684C, TDS 680C).
500 MHz (TDS 654C).

Main Trigger Modes – Auto, Normal, Single.

Delayed Trigger – Delay by time, events, or events and time.

Delay by Time Range – 16ns to 250 s.

Delay by Events Range – 2 to 9,999,999 events.

External Trigger Input – Input Impedance: ≥1.5 kΩ; Max. InputVoltage: ±20V (DC + peak AC).

DISPLAY CHARACTERISTICS

Waveform Style – Dots, vectors, variable persistence from 32 ms to 10 s, infinite persistence, and intensified samples.

Color (TDS 694C, TDS 684C, TDS 654C) – Standard palettes and user-definable color for waveforms, text, graticules, and cursors. Measurement text and cursor colors matched to waveform. Waveform collision areas highlighted with different color. Statistical waveform distribution shown with color grading through variable persistence.

Color Grading (TDS 694C, TDS 684C, TDS 654C) – With variable persistence selected, historical timing information is represented by temperature or spectral color scheme (or gray scale on TDS 680C) providing "z-axis" information about rapidly-changing waveforms.

Graticules – Full, grid, cross-hair, frame, and NTSC and PAL (with video trigger option).

Format – YT and XY.

Resolution – 640 horizontal by 480 vertical displayed pixels (VGA).

Color CRT Monitor (TDS 654C/684C/694C) – 7 in. diagonal NuColor™ liquid crystal full-color shutter, 256 levels.

Monochrome CRT Monitor (TDS 680C) –
7 in. diagonal, magnetic deflection. Horizontal raster-scan. P4 white phosphor.

MEASUREMENT SYSTEM

Automatic Waveform Measurements – Period, frequency, + width, –width, rise time, fall time, + duty cycle, –duty cycle, delay, phase, burst width, high, low, max, min, peak to peak, amplitude, + overshoot, –overshoot, mean, cycle mean, RMS, cycle RMS, area, cycle area, extinction ratio (ratio,dB, %), and mean optical power. Continuous update of up to four measurements on any combination of waveforms.

Measurement Statistics – Display minimum and maximum or mean and standard deviation on any displayed single-waveform measurements.

Cursor Measurements – Absolute, Delta:Volts, Time, Frequency, and NTSC IRE and line number (with video trigger option).

Cursor Types – Horizontal bars (volts), vertical bars (time); operated independently or in tracking mode.

Histogram Measurements – Mean, median, standard deviation, hits, waveform count, peak hits, peak to peak, % mean ± 1, 2, and 3 standard deviations.

WAVEFORM PROCESSING

Waveform Functions – Interpolation (sin(x)/x or linear), Average, Envelope, Auto Setup.

Advanced Waveform Functions – FFT, Integration, Differentiation, Waveform (math or acquired) Limit Testing.

Arithmetic Operators – Add, Subtract, Multiply, Divide, Invert.

Waveform Limit Testing – Compares incoming or math waveform to a reference waveform's upper and lower limits.

Waveform Histograms – Both vertical and horizontal histograms, with periodically updated measurements, allow statistical distributions to be analyzed over any region of the signal.

Dual Window Zoom – Dual graticules simultaneously show selected and zoomed waveforms. Up to two zoom boxes show areas on the selected trace that are being magnified, and the two magnified areas can be overlapped for quick comparison. Color of zoomed trace matches selected trace.

POWER REQUIREMENTS

Line Voltage Range – 90 to 250V RMS.

Line Frequency – 45 to 440Hz.

Power Consumption –
300 W max. (TDS 654C/680C/684C)
450 W max. (TDS 694C)

ENVIRONMENTAL AND SAFETY

Temperature –
Operating: +4°C to +45°C (floppy not used), +10°C to +45°C (floppy in use). Non-operating:–22°C to +60°C.
TDS 694C: Operating: +5°C to +40°C (floppy not used), +10°C to +40°C (floppy in use). Non-operating:–22°C to +60°C.

Humidity –
Operating: 20% to 80% RH at or below +32°C.

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TDS 600 Series Characteristics Continued

Altitude –
Operating: 15,000 ft. (hard disk not used), 10,000 ft. (hard disk in use). Non-operating: 40,000 ft.

Electromagnetic Compatibility – Meets or exceeds EN55011 Class A Radiated and Conducted Emissions; EN 50081-1; EN60555-2 Power Harmonics; FCC 47 CFR, Part 15. Subpart B, Class A; Australian EMC Framework; EN 50082-1

Safety – UL 3111-1, CSA-22.2 No. 1010.1

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height with feet	193	7.6
Height without feet	178	7
Width with handle	445	17.5
Depth with front cover installed	434	17.1

Weight	kg	lbs.
Net approximately	14.1	31
Shipping Weight approximately	24.0	53

TDS 600 Series Ordering Information

TDS 694C

Four-channel Color 3GHz, 10GS/s Per Channel, Digital Real-Time Oscilloscope.

Includes: User Manual (070-0473-00), Quick Reference Guide (071-2313-00), Programmer's Manual in MS-Help format on floppy disk (063-3060-00), Technical Reference (Performance Verification) Manual (071-0496-00), Probe Deskew Fixture (679-4809-00), Footswitch and Adapter (260-1189-02 and 013-0312-00).

TDS 684C

Four-channel Color 1 GHz, 5 GS/s Per Channel Digital Real-Time Oscilloscope.

TDS 680C

Two-channel Monochrome 1 GHz, 5 GS/s Per Channel Digital Real-Time Oscilloscope.

TDS 654C

Four-channel Color 500MHz, 5 GS/s Per Channel Digital Real-Time Oscilloscope. Includes: Four P6243 FET Probes.

TDS 684C/680C/654C Include

User Manual (070-0130-00), User Supplement (071-0273-00), Quick Reference Guide (020-2235-00), Programmer's Manual in MS-Help format on floppy disk (063-3120-00), Technical Reference Manual (071-0272-00).

All Include

Front Cover (200-3696-00), North American Power Cord (161-0230-01), Accessory Pouch 016-1268-00 (Except TDS 680C).

Options Available

Opt. 05 – Video Trigger, NTSC, PAL, HDTV, FlexFormat™. (Except TDS 694C)

Opt. 1K – Model K420 Instrument Cart.

Opt. 1M – 120 k Record Length. (TDS 694C only)

Opt. 1R – Rackmount Kit.

Opt. 31 – Add 1 ea. P6339A Buffered Passive Probe. (TDS 694C only)

Opt. 33 – Add 1 ea. P6158 Low Capacitance Probe. (Except TDS 654C)

Opt. 34 – Add 1 ea. P6247 Differential Probe. (Except TDS 694C)

Opt. 35 – Add 1 ea. P6243 Active Probe. (TDS 654C Only)

Opt. 36 – Add 1 ea. P6139A Passive Probe. (Except TDS 694C)

Opt. 37 – Add 1 ea. P6245 Active Probe. (Except TDS 654C)

Opt. 38 – Add 1 ea. P6249 4 GHz Active Probe. (TDS 694C only)

Opt. 39 – Add 1 ea. P6248 1.7 GHz Differential Probe. (TDS 694C only)

Opt. HD – Internal Hard Disk Drive.

International Power Plug Options

Opt. A1 – Universal Euro 220V, 50Hz.

Opt. A2 – UK 240V, 50Hz.

Opt. A3 – Australian 240V, 50Hz.

Opt. A5 – Switzerland 220V, 50 Hz.

Software

TDS JAVA™ APPLICATIONS

TDSJIT1 – Jitter and timing analysis application.

TDSDDM1 – Hard disk drive measurement application.

TDSPSM1 – Processor specifications measurement application.

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